CLAIMS

Sub A1

1. A material for a semiconductor-mounting heat dissipation substrate, the material being a copper-molybdenum rolled composite obtained by infiltrating and filling melted copper in a void or gap between powder particles of a molybdenum powder compact to produce a composite of molybdenum and copper and rolling the composite, the rolled composite having a coefficient of linear expansion of 8.3×10^{-6}/K or less at 30-800℃ in a final rolling direction in which a plate material is rolled.

2. A material for a semiconductor-mounting heat dissipation substrate as claimed in claim 1, wherein the rolled composite is a rolled product subjected to primary rolling in one direction at a temperature of 100-300℃ and at a working rate of 50% or more and then subjected to secondary rolling as cold rolling in a direction intersecting with the one direction at a working rate of 50% or more, a total working rate being 60% or more, the coefficient of linear expansion in the secondary rolling direction at 30-800℃ being $7.2\text{-}8.3 \times 10^{-6}$/K.

3. A material for a semiconductor-mounting heat dissipation substrate of a copper-clad type, comprising a copper/copper-molybdenum composite/copper clad material formed by press-bonding copper plates to both surfaces of a rolled composite, the rolled composite being the material for a semiconductor-mounting heat dissipation substrate of claim 1.

4. A material for a semiconductor-mounting heat dissipation substrate of a copper-clad type as claimed in claim 3, wherein the copper-molybdenum composite forming an intermediate layer has a coefficient of linear expansion of 8.3×10^{-6}/K or less at a temperature not higher than 400℃ by controlling the ratio of copper and molybdenum and the reduction percentage, the material having a coefficient of linear expansion of 9.0×10^{-6}/K or less at a temperature not higher than 400℃.

Sub A1 cont

5. A material for a semiconductor-mounting heat dissipation substrate of a copper-clad type as claimed in claim 3, wherein the copper-molybdenum composite forming an intermediate layer has a coefficient of linear expansion of 8.3 x 10^{-6}/K or less at a temperature of 30-800℃, the material having a coefficient of linear expansion of 9.0 x 10^{-6}/K or less at a temperature of 30-800℃.

6. A ceramic package comprising a heat dissipation substrate made of a material for a semiconductor-mounting heat dissipation substrate of a copper-clad type as claimed in claim 5.

7. A method of producing a material for a semiconductor-mounting heat dissipation substrate, comprising the steps of press-forming molybdenum powder having an average particle size of 2-5 μm at a pressure of 100-200 MPa to obtain a molybdenum powder compact, impregnating melted copper into a void between powder particles of the molybdenum powder compact in a nonoxidizing atmosphere at 1200-1300℃ to obtain a composite of molybdenum and copper which contains 70-60% molylbdenum in weight ratio, the balance copper, and rolling the composite at a working rate of at least 60% to produce a rolled composite, the rolled composite having a coefficient of linear expansion of 8.3 x 10^{-6}/K or less at 30-800℃ in a final rolling direction.

8. A method of producing a material for a semiconductor-mounting heat dissipation substrate as claimed in claim 7, comprising a rolling process in which primary rolling is carried out in one direction at a temperature of 100-300℃ and at a working rate of 50% or more and secondary rolling is carried out as cold rolling in a direction intersecting with the one direction at a working rate of 50% or more, a total working rate being 60% or more, thereby producing a rolled composite of molybdenum and copper which has a coefficient of linear expansion of 7.2-8.3 x 10^{-6}/K at 30-800℃ in the secondary rolling direction.

Sub A1 cont

9. A method of producing a material for a semiconductor-mounting heat dissipation substrate as claimed in claim 7, further comprising the step of press-bonding copper plates to both surfaces of the rolled composite to obtain a substrate for a semiconductor-mounting heat dissipation substrate of a copper-clad type.

10. A method of producing a material for a semiconductor-mounting heat dissipation substrate as claimed in claim 9, comprising the steps of rolling the copper-molybdenum composite as an intermediate layer with the ratio of copper and molybdenum and the reduction percentage controlled so that a resultant rolled composite has a coefficient of linear expansion equal to 8.3 x 10^{-6}/K or less at a temperature not higher than 400℃, and thereafter press-bonding copper on both surfaces of the rolled composite to obtain a copper-clad rolled composite having a coefficient of linear expansion of 9.0 x 10^{-6}/K or less at a temperature not higher than 400℃.

11. A method of producing a material for a semiconductor-mounting heat dissipation substrate as claimed in claim 9, comprising the steps of obtaining the copper-molybdenum composite forming an intermediate layer having a coefficient of linear expansion of 8.3 x 10^{-6}/K or less at a temperature of 30-800℃ by controlling the ratio of copper and molybdenum and the reduction percentage, and press bonding copper on both surfaces of the copper-molybdenum composite to obtain a copper-clad rolled composite having a coefficient of linear expansion of 9.0 x 10^{-6}/K or less at a temperature of 30-800℃.

12. According to this invention, there is also provided a method of producing a ceramic package, comprising the steps of:

press-forming molybdenum powder having an average particle size of 2-5 μm at a pressure of 100-200 MPa to obtain a molybdenum powder compact, impregnating melted copper into a void between powder particles of the

Sub B1 Cont

molybdenum powder compact in a nonoxidizing atmosphere at 1200-1300℃ to obtain a copper-molybdenum composite containing 70-60% molylbdenum in weight ratio, the balance copper, and rolling the composite at a working rate of at least 60% to produce a rolled composite having a coefficient of linear expansion of 8.3 x 10^{-6}/K or less at 30-800℃ in a final rolling direction;

press-bonding copper plates to both surfaces of the rolled composite to obtain a copper-clad rolled composite having a coefficient of linear expansion of 9.0 x 10^{-6}/K or less at a temperature of 30-800℃; and

directly brazing the copper-clad rolled composite with ceramic having a metallize layer affixed to its surface.

13. A rolled composite formed by impregnating copper into a void between powder particles of molybdenum powder compact and rolling said powder compact, wherein the coefficient of linear expansion of the rolled composite is defined by the direction of final rolling in the rolling process and is equal to 8.3 x 10^{-6}/K or less in a temperature range of 30-800℃.

14. A rolled composite as claimed in claim 13, wherein the coefficient of linear expansion is 7.2-8.3 x 10^{-6}/K in a temperature range of 30-800℃.